CLAIMS:

We claim:

1. A thermoplastic film comprising:

(a) a core layer comprising a polyolefin wherein the core layer comprises the interior of the film;

(b) a first transition layer comprising a polyolefin and a silicone additive, wherein the first transition layer is exterior to the core layer; and

(c) a first skin layer comprising a polyolefin wherein the first skin layer is exterior to the first transition layer and the core layer.

2. The film of claim 1 wherein the first skin layer has an exposed surface and wherein the exposed surface of the first skin layer is subjected to a treatment selected from the group consisting of corona discharge, plasma, and flame.

3. The film of claim 1 in which the silicone additive of the first transition layer is a polydialkylsiloxane.

4. The film of claim 1 in which the silicone additive of the first transition layer is a polydimethylsiloxane.

5. The film of claim 1 in which a sufficient amount of silicone additive is incorporated in the first transition layer as to migrate through the first skin layer to an exposed surfaces of the first skin layer to confer a coefficient of friction of less than about 0.7.

6. The film of claim 1 in which a sufficient amount of silicone additive is incorporated in the first transition layer as to migrate through the first skin layer to an exposed surfaces of the first skin layer to confer a coefficient of friction from about 0.2 to about 0.5.

7. The film of claim 1 wherein the first skin layer further comprises an anti-blocking agent and wherein at least a major proportion of the anti-blocking agent is in the form of particles of approximately spherical shape.

8. The film of claim 7 wherein the anti-blocking agent is selected from the group consisting of silica, cross-linked methacrylate, and polymethylsilosiloxane.

9. The film of claim 7 wherein the anti-blocking agent is silica particles wherein at least a major proportion of which are approximately spherical in shape.

10. The film of claim 1 wherein the first skin layer comprises a polymer selected from the group consisting of ethylene-propylene-butene-1 terpolymer, ethylene-propylene random copolymer, propylene-butene-1 copolymer, MDPE, LLDPE, LDPE, EVA, EMA, surlyn ionomer, and mixtures thereof.

11. The film of claim 10 wherein the ethylene-propylene-butene-1 terpolymer component comprises from about 10 to about 90 weight percent of the blend and the ethylene-propylene random copolymer comprises from about 10 to about 90 weight percent of the blend.

12. The film of claim 10 in which the ethylene-propylene-butene-1 terpolymer is obtained from the random interpolymerization of from about 1 to about 8 weight percent ethylene with from about 65 to 95 propylene with butene-1 making up the balance of the terpolymer.

13. The film of claim 10 in which the ethylene-propylene-butene-1 terpolymer is obtained from the random interpolymerization of from about 3 to about 6 weight percent ethylene with from about 86 to about 93 weight percent propylene with butene-1 making up the balance of the terpolymer.

14. The film of claim 10 in which the ethylene-propylene random copolymer is obtained from the random co-polymerization of from about 2 to about 8 weight percent ethylene with propylene making up the balance of the copolymer.

15. The film of claim 10 in which the propylene-butene-1 copolymer is obtained from the random co-polymerization of from about 1 to about 16 weight percent butene-1 with propylene making up the balance of the copolymer.

16. The film of claim 1 wherein the core layer comprises a polymer selected from the group consisting of a polypropylene homopolymer, a high-density polyethylene, a linear low-density polyethylene, a ethylene-propylene copolymer, and mixtures thereof.

17. The film of claim 1 wherein the transition layer comprises a polymer selected from the group consisting of polypropylene homopolymer, medium-density polyethylene, linear low-density polyethylene, low-density polyethylene, ethylene-propylene copolymer, propylene-butene copolymer, ethylene-propylene-butene terpolymer, EVA, EMA, surlyn ionomer, and mixtures thereof.

18. The film of claim 1 in which the core layer comprises at least about 70 percent of the total thickness of the film.

19. The film of claim 18 in which the total thickness of the film is from about 0.35 to about 2.0 mils.

20. The film of claim 1 wherein the first transition layer has a thickness of about 0.2 to about 6 microns and wherein the first skin layer has a thickness of about 0.1 to about 3 microns.

21. The film of claim 1 wherein the silicone additive has a viscosity greater than about 1,000,000 centistokes.

22. The film of claim 1 wherein the silicone additive has a viscosity from about 10,000,000 centistokes to about 50,000,000 centistokes.

23. The film of claim 1 wherein the silicone additive has a viscosity greater than about 1,000 centistokes.

24. The film of claim 1 wherein the first transition layer comprises from about 0.2% to about 4% by weight of the silicone additive.

25. The film of claim 1 wherein the first transition layer comprises from about 0.6% to about 2% by weight of the silicone additive.

26. The film of claim 1 wherein the first transition layer comprises from about 0.6% to about 2% by weight of the silicone additive, and wherein the silicone additive has a viscosity from about 10,000,000 centistokes to about 50,000,000 centistokes.

27. The film of claim 1 wherein the exterior side of the first skin layer is coated with a coating selected from the group consisting of acrylics, PVDC, PVOH, and mixtures thereof.

28. The film of claim 1 wherein the exterior side of the first skin layer is vacuum metallized.

29. The film of claim 1 having a seal strength of at least about 200 grams per inch and having a coefficient of friction of at most about 0.65.

30. The film of claim 1 having a seal strength of at least about 240 grams per inch and having a coefficient of friction of at most about 0.4.

31. A method of making a film comprising the steps of:

(1) coextruding a film through a die wherein the film comprises a core layer comprising a polyolefin wherein the core layer comprises the interior of the film; a first transition layer comprising a polyolefin and a silicone additive, wherein the first transition layer is exterior to the core layer; and a first skin layer comprising a polyolefin, and being substantially free of a silicon additive, wherein the first skin layer is exterior to the first transition layer, and wherein the first skin layer is exterior to the core layer;

(2) cooling/quenching the film; and

(3) surface treating one or more exposed surfaces of the film with a corona, flame, or plasma treatment.

32. The method of claim 31 further comprising the step of orienting the film in the machine direction.

33. The method of claim 32 further comprising the step of orienting the film in the transverse direction.

34. A thermoplastic film comprising:

(a) a core layer comprising polypropylene homopolymer, wherein the core layer comprises the interior of the film;

(b) a first tie layer exterior to and on one side of said core layer, said first tie layer comprising a silicon additive and a material selected from the group consisting of ethylene-propylene-butylene (EPB) terpolymers, ethylene-propylene (EP) copolymers, propylene-butylene random copolymers, linear low density polyethylenes, polypropylene homopolymer, and blends thereof;

(c) a first skin layer exterior to said core layer and said first tie layer, and on the same side of said core as said first tie layer, wherein said first skin layer comprises material selected from the group consisting of ethylene-propylene-butylene (EPB) terpolymers, ethylene-propylene (EP) copolymers, propylene-butylene random copolymers, linear low density polyethylenes, and blends thereof; and

(d) a second skin layer exterior to said core layer and on a side of said core opposite to said first tie layer and first skin layer, wherein said second skin layer comprises a material selected from the group consisting of ethylene-propylene-butylene (EPB) terpolymers, ethylene-propylene (EP) copolymers, propylene-

butylene (PB) random copolymers, linear low density polyethylenes, high density polyethylenes, medium density polyethylenes, polypropylene homopolymers, and blends thereof.

35. The film according to claim 34, wherein the second skin layer (d) is flame, plasma, or corona discharge treated.

36. The film according to claim 34, wherein the first skin layer (c) is flame, plasma, or corona discharge treated.

37. The film according to claim 35, wherein the first skin layer (c) is flame, plasma, or corona discharge treated.

38. A thermoplastic film comprising:

(a) a core layer comprising polypropylene homopolymer, wherein the core layer comprises the interior of the film;

(b) a first tie layer exterior to and on one side of said core layer, said first tie layer comprising a silicon additive and a material selected from the group consisting of ethylene-propylene-butylene (EPB) terpolymers, ethylene-propylene (EP) copolymers, propylene-butylene random copolymers, polypropylene homopolymer, and blends thereof;

(c) a first skin layer exterior to said core layer and said first tie layer on the same side of said core as said first tie layer, wherein said first skin layer comprises material selected from the group consisting of ethylene-propylene-butylene (EPB) terpolymers, ethylene-propylene (EP) copolymers, propylene-butylene random copolymers, and blends thereof;

(d) a second tie layer exterior to said core layer and on a side of said core layer opposite to said first tie layer and first skin layer, said second tie layer comprising a silicon additive and a material selected from the group consisting of ethylene-propylene-butylene (EPB) terpolymers, ethylene-propylene (EP) copolymers, propylene-butylene random copolymers, polypropylene homopolymer, and blends thereof;

(e) a second skin layer exterior to said core layer and said second tie layer, and on a side of said core opposite to said first tie layer and first skin layer, wherein said second skin layer comprises a material selected from the group consisting of ethylene-propylene-butylene (EPB) terpolymers, ethylene-propylene

(EP) copolymers, propylene-butylene (PB) random copolymers, and blends thereof.

39. The film according to claim 38, wherein the second skin layer (e) is flame, plasma, or corona discharge treated.

40. The film according to claim 38, wherein the first skin layer (c) is flame, plasma, or corona discharge treated.

41. The film according to claim 39, wherein the first skin layer (c) is flame, plasma, or corona discharge treated.

42. A thermoplastic film comprising:

(a) a core layer comprising polypropylene homopolymer, wherein the core layer comprises the interior of the film;

(b) a first tie layer exterior to and on one side of said core layer, said first tie layer comprising a silicon additive and a material selected from the group consisting of ethylene-propylene-butylene (EPB) terpolymers, ethylene-propylene (EP) copolymers, propylene-butylene random copolymers, polypropylene homopolymer, and blends thereof;

(c) a first skin layer exterior to said core layer and said first tie layer on the same side of said core as said first tie layer, wherein said first skin layer comprises material selected from the group consisting of ethylene-propylene-butylene (EPB) terpolymers, ethylene-propylene (EP) copolymers, propylene-butylene random copolymers, and blends thereof;

(d) a second tie layer exterior to said core layer and on a side of said core layer opposite to said first tie layer and first skin layer, said second tie layer comprising a material selected from the group consisting of polypropylene homopolymer, maleic anhydride grafted polypropylene, and blends thereof;

(e) a second skin layer exterior to said core layer and said second tie layer, and on a side of said core opposite to said first tie layer and first skin layer, wherein said second skin layer comprises a material selected from the group consisting of amorphous polyamides, EVOH copolymers, high density polyethylenes, and blends thereof.

43. The film according to claim 42, wherein the second skin layer (e) is flame, plasma, or corona discharge treated.

44. The film according to claim 42, wherein the first skin layer (c) is flame, plasma, or corona discharge treated.

45. The film according to claim 43, wherein the first skin layer (c) is flame, plasma, or corona discharge treated.

46. The film of claim 42 wherein the exterior side of the second skin layer is vacuum metallized with aluminum.

47. The film of claim 43 wherein the the exterior side of the second skin layer is vacuum metallized with aluminum.

48. The film of claim 1, wherein said core layer further comprises an additive selected from the group consisting of:

an opacifying agent selected from the group consisting of iron oxide, carbon black, aluminum, TiO_2, talc, or combinations thereof, said opacifying agent present in said core layer in the range of from about 1 wt% to about 15 wt%, based on the total weight of the core layer;

a material selected from the group consisting of polybutene teraphthalate, nylon, solid glass spheres, hollow glass spheres, metal beads, metal spheres, ceramic spheres, $CaCO_3$, or combinations thereof, present in said core layer in the range of from about 1 wt% to about 20 wt%, said material having a mean particle size in the range of from 0.1 - 10 μm;

a hydrocarbon wax having a melting point in the range of from about 52° C to about 88° C, and a molecular weight in the range of about 300 to about 800;

a hydrocarbon resin, said resin being one of petroleum resin, terpene resin, styrene resin, cyclopentadiene resin, saturated alicyclic resin, or combinations thereof, said resin having an average molecular weight of less than about 5000, having a softening point in the range of from about 60° to about 180° C, said resin present in said core layer at less than about 15 wt%; and

combinations thereof.

49. The film of claim 34, wherein said core layer further comprises an additive selected from the group consisting of:

an opacifying agent selected from the group consisting of iron oxide, carbon black, aluminum, TiO_2, talc, or combinations thereof, said opacifying

agent present in said core layer in the range of from about 2 wt% to about 4 wt%, based on the total weight of the core layer;

a material selected from the group consisting of polybutene teraphthalate, nylon, solid glass spheres, hollow glass spheres, metal beads, metal spheres, ceramic spheres, $CaCO_3$, or combinations thereof, present in said core layer in the range of from about 1 wt% to about 20 wt%, said material having a mean particle size in the range of from 0.1 - 10 μm;

a hydrocarbon wax having a melting point in the range of from about 52° C to about 88° C, and a molecular weight in the range of about 300 to about 800;

a hydrocarbon resin, said resin being one of petroleum resin, terpene resin, styrene resin, cyclopentadiene resin, saturated alicyclic resin, or combinations thereof, said resin having an average molecular weight of less than about 5000, having a softening point in the range of from about 60° to about 180° C, said resin present in said core layer at less than about 15 wt%; and

combinations thereof.

50. The film of claim 38, wherein said core layer further comprises an additive selected from the group consisting of:

an opacifying agent selected from the group consisting of iron oxide, carbon black, aluminum, TiO_2, talc, or combinations thereof, said opacifying agent present in said core layer in the range of from about 2 wt% to about 4 wt%, based on the total weight of the core layer;

a material selected from the group consisting of polybutene teraphthalate, $CaCO_3$, or combinations thereof, present in said core layer in the range of from about 2 wt% to about 10 wt%, said material having a mean particle size in the range of from 0.1 - 10 μm;

a hydrocarbon resin, said resin being one of petroleum resin, terpene resin, styrene resin, cyclopentadiene resin, saturated alicyclic resin, or combinations thereof, said resin having an average molecular weight of less than about 5000, having a softening point in the range of from about 60° to about 180° C, said resin present in said core layer at less than about 10 wt%; and

combinations thereof.

51. The film of claim 42, wherein said core layer further comprises from about 2 wt% to about 10 wt% of polybutene teraphthalate, said polybutene teraphthalate having a mean particle size in the range of from about 0.1 to about 10 μm.